VILNIUS UNIVERSITY
MEDICAL FACULTY

The Final thesis

Psychosomatic Aspects in Pediatric Disorders

Carl Frieder von Eisenhart-Rothe, VI year, Group 6

Institute of Clinical Medicine, Clinic of Psychiatry

Supervisor Prof. dr. Sigita Lesinskienė

The Head of Department/Clinic Prof. dr. Sigita Lesinskienė

2024

Email of the student: frieder.von@mf.stud.vu.lt

1. Abstract

The intricate relationship between psychological and physical health in pediatric medicine is a focal point in understanding and addressing pediatric disorders. Psychosomatics in this context elucidates how emotional or mental factors significantly influence the onset, progression, or exacerbation of physical illnesses in children. A comprehensive grasp of these psychosomatic aspects is imperative for holistic pediatric care, as they profoundly impact disease outcomes, treatment adherence, and overall well-being.

By recognising and addressing the psychosocial factors that contribute to the onset, progression, and management of pediatric disorders, healthcare providers can implement tailored interventions that promote, e.g. resilience, coping strategies, and adaptive functioning in pediatric patients and their families.

Understanding the biopsychosocial framework of pediatric disorders is important for effective treatment methods and improved outcomes, as it necessitates a holistic approach that considers the interplay between biological, psychological, and social factors.

Delving into the intricate interplay of psychosomatic aspects within pediatric disorders, this exploration illuminates diverse facets, including stress, family dynamics, coping mechanisms, and attachment theory. It offers insight into the manifestation and management of conditions such as headaches and migraine, chronic pain, and various other pediatric disorders. A nuanced understanding of these factors not only enhances diagnostic accuracy but also informs personalised treatment strategies, ensuring better outcomes and improved quality of life for pediatric patients.

2. Keywords

Psychosomatics, psychosomatic aspects, pediatric disorders, stress, treatment methods, family dynamics, coping mechanisms, attachment, headache and migraine, chronic pain, biopsychosocial, quality of life.

3. Introduction

In 1948, the World Health Organization proclaimed that health transcends mere physical well-being: *"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"* (1). It encompasses every aspect of a person's existence, including their physical, emotional, intellectual, and social dimensions (1).

The intersection of psychological and physical health has long been recognised as a critical aspect of pediatric medicine.

In pediatric disorders, psychosomatic aspects refer to the complex interplay between psychological factors and physical symptoms. Emotional or mental factors contribute significantly to the onset, progression, or exacerbation of physical illness in children. Understanding these psychosomatic aspects is paramount for comprehensive pediatric care, as they can profoundly influence disease outcomes, treatment adherence, and overall well-being (2).

Psychosomatic disorders in children encompass a wide range of conditions, including but not limited to gastrointestinal disorders, respiratory illnesses, dermatological conditions, and chronic pain syndromes. While the physical manifestations of these disorders are often the focus of clinical attention, psychosocial dimensions often underlie their presentation and progression (2). These disorders often present diagnostic and therapeutic challenges for healthcare professionals, as they necessitate a holistic approach that considers both biological and psychological factors.

The biopsychosocial model, particularly relevant within the field of psychosomatic medicine, offers a multifaceted approach to understanding pediatric disorders with psychosomatic aspects. In 1960, George Engel criticised the concept of disease by saying: *"The traditional attitude toward disease tends in practice to restrict what it categorised as disease to what can be understood or recognised by the physician and what he notes can be helped by his intervention. This attitude has plagued medicine throughout its history and still stands in the way of physicians' fully appreciating disease as a natural phenomenon"*(3).

Engel conceptualised the biopsychosocial model in 1977, proposing that comprehending a person's medical condition entails not only considering biological factors but also incorporating psychological and social factors (4).

The model recognises that a child's well-being is influenced not only by biological factors such as genetics and physiological processes but also by psychological factors like emotions, thoughts, and coping strategies, as well as social factors such as family dynamics, peer relationships, socioeconomic status, and cultural context (5).

In the context of pediatric disorders with psychosomatic components, the biopsychosocial model underscores the importance of considering all these factors holistically (6). Child's emotional state, stress levels, and coping mechanisms can profoundly impact the expression and management of physical symptoms. Similarly, family dynamics, social support networks, and access to healthcare services can significantly influence the child's overall health outcomes.

The hypothesis driving this literature review is that a deeper understanding of psychosomatic aspects in pediatric disorders can lead to more effective interventions and improved outcomes for children facing these complex health challenges.

By fostering a deeper understanding of the interplay between mind and body in pediatric healthcare, the goal of this review is to investigate the role of psychosomatic factors in the aetiology, progression, and management of pediatric disorders with the overarching aim of improving the well-being and quality of life of children affected by pediatric disorders.

4. Literature selection strategy

This literature review aims to synthesise existing research on psychosomatic aspects in pediatric disorders using free full-text articles available in academic databases and repositories. The methodology follows a systematic approach to identify and select relevant studies for inclusion in the review.

An electronic search for articles from English literature databases such as PubMed, Google Scholar, Cochrane Library and Science Direct was performed. Articles were included if they were published in the last 10 years (from 2014 to 2024). Case reports, reviews, clinical trials, meta-analyses, and guidelines are included. The selection of articles was restricted to English-language publications. Searched terms include psychosomatics, pediatric disorders, stress, family dynamics, attachment theory, illness perception, coping mechanisms, social support and biological and cognitive factors.

5. Psychosomatic aspects

Psychosomatic aspects in pediatric disorders refer to the interconnected relationship between a child's psychological state and the manifestation of physical symptoms or illnesses. These symptoms may manifest as real physical ailments without an underlying organic cause. The aspects underscore how emotional, cognitive, and behavioural factors can influence the onset, severity, and course of various medical conditions in children. This phenomenon suggests that psychological factors, such as stress, trauma, or emotional distress, can exacerbate or even precipitate physical symptoms or diseases in pediatric patients.

5.1. Stress

Stress, as a psychosomatic aspect in pediatric disorders, is a significant and multifaceted phenomenon. During childhood and adolescence, encountering both acute and chronic stressful events and adversity emerges as one of the most significant risk factors for psychopathology (7). In the context of pediatric disorders, stress can be defined as a

physiological and psychological response to various environmental, emotional, or developmental challenges experienced by children. This stress response can have profound effects on the child's physical health, exacerbating existing medical conditions or even contributing to the development of new ones.

Stress can manifest in various forms in pediatric populations, ranging from acute stressors such as traumatic events, medical procedures, or family disruptions to chronic stressors like ongoing interpersonal conflicts, socioeconomic adversity, or chronic illness (8).

The impact of stress on pediatric disorders is wide-ranging. For instance, in children with chronic medical conditions such as asthma, eczema, or gastrointestinal disorders, stress can trigger or worsen symptoms.

Stress can also arise from internal sources such as self-esteem issues or academic pressure (9). The effects of stress extend beyond immediate symptom exacerbation, potentially impacting long-term disease progression, treatment adherence, and overall quality of life.

5.2. Attachment theory

Attachment theory provides a compelling framework for understanding psychosomatic aspects in pediatric disorders, emphasising the critical role of early caregiver-child relationships in shaping children's emotional and physical well-being. Developed by John Bowlby, attachment theory posits that infants and young children form strong emotional bonds, or attachments, with their primary caregivers, which profoundly influence their socioemotional development, coping strategies, and stress responses (10).

In the context of pediatric disorders, attachment theory highlights how disruptions or insecurities in attachment relationships can contribute to the onset, exacerbation, or maintenance of physical symptoms and illnesses. For example, children who experience insecure attachment patterns characterised by ambivalence, avoidance, or disorganisation may be more vulnerable to stress-induced physiological dysregulation, compromising their immune function, hormonal balance, and neural pathways involved in emotion regulation and pain modulation.

Attachment-related stressors can take various forms, including separation from caregivers due to hospitalisation or parental absence, experiences of neglect or maltreatment, and inconsistent or insensitive caregiving practices (11).

The attachment theory underscores the importance of secure attachment relationships as a protective factor against the adverse effects of stress on pediatric health outcomes. Insecure attachment relationship development in children increases the risk of elevated mental health

problems due to long exposure to distress (12). Children who develop secure attachments with responsive, emotionally available caregivers are more likely to develop adaptive coping mechanisms, regulatory skills, and a sense of emotional security, which buffer against the impact of stressors on their physical health (13).

5.3. Family dynamics

Family dynamics play a crucial role as psychosomatic aspects in pediatric disorders, encompassing the interactions, relationships, and communication patterns within the family unit that influence children's physical and psychological health outcomes (14).

Understanding family dynamics is essential for comprehensively assessing and addressing the biopsychosocial factors contributing to pediatric disorders and their manifestation of psychosomatic symptoms.

Family dynamics encompass various components, including parental relationships, sibling interactions, parenting styles, familial roles and responsibilities, and the overall emotional climate within the family (15). These dynamics can have a profound impact on children's stress levels, coping strategies, and vulnerability to psychosomatic symptoms and disorders.

Positive family dynamics characterised by warmth, cohesion, open communication, and adaptive coping strategies can enhance children's resilience, emotional well-being, and treatment outcomes. Contrariwise, dysfunctional family dynamics marked by conflict, neglect or overprotection can exacerbate stress and contribute to the development or exacerbation of pediatric disorders (16).

Family dynamics influence pediatric disorders through various pathways. Parental stress, marital conflict, or caregiver mental health issues can disrupt the emotional climate within the family, creating an environment characterised by tension, instability, or neglect. Children from divorced families tend to experience reduced psychological wellness and exhibit more behavioural issues compared to those raised in families that remain together (14,17)..

5.4. Coping mechanisms

Coping mechanisms manifested as psychosomatic aspects in pediatric disorders represent a complex interplay between psychological stressors and physiological responses in children and adolescents. Effective coping with stressful events and emotional regulation in various situations may be crucial in fostering resilience and lowering the likelihood of psychopathology during childhood and adolescence (7).

5.4.1. Somatisation

Children may convert emotional distress into physical symptoms, such as headaches or gastrointestinal problems, as a way to cope with overwhelming feelings. These physical complaints may become chronic or recurrent if the underlying psychological stressors persist.

5.4.2. Avoidance

Some children may adopt avoidance behaviours, such as withdrawing from social interactions and activities that trigger anxiety or stress (18). This coping mechanism may provide temporary relief from distress but can lead to long-term social and developmental challenges.

5.4.3. ´Maladaptive coping

Some children may resort to maladaptive coping strategies, such as substance abuse, self-harm, or disordered eating patterns, to cope with psychological distress. These coping mechanisms can exacerbate existing health issues and lead to further complications (19).

5.5. Social support

Social support plays a pivotal role in pediatric disorders, acting as a psychosomatic aspect that significantly influences the well-being and health outcomes of children facing various medical conditions. Social support encompasses a spectrum of tangible and intangible resources provided by individuals, families, and communities, which have profound effects on the psychological and physiological functioning of pediatric patients (20).

Through various mechanisms, such as emotional reassurance, instrumental aid, and informational guidance, social support fosters resilience, coping abilities, and adaptive responses to illness, thereby promoting better treatment adherence and disease management (20).

It is also significant to consider the developmental stage and individual needs of pediatric patients when assessing the impact of social support on psychosomatic aspects. Children rely heavily on their social networks, including parents, peers, and healthcare professionals, for emotional validation, practical assistance, and social integration during times of illness. The quality and quantity of social support received by pediatric patients influence their perceptions of illness, coping strategies, and overall adjustment to medical conditions, underscoring its indispensable role in pediatric psychosomatic medicine (20).

5.6. Cognitive factors

Cognitive factors are essential in both the development and management of pediatric psychosomatic disorders, encompassing various cognitive processes like perceptions, beliefs, interpretations, and coping strategies. Maladaptive cognitive-behavioural patterns, such as catastrophising or excessive worrying, are prevalent in these disorders, exacerbating physical

symptoms and perpetuating the condition. Patient's understanding and perception of their illness significantly influence their emotional and physical responses; those perceiving their condition as uncontrollable or threatening may experience heightened anxiety and more severe symptoms (21). Cognitive factors also influence attentional processes and awareness of bodily sensations; hypervigilance to symptoms or selective focus on illness-related stimuli can amplify somatic complaints. Cognitive biases, like selective attention to negative information or confirmation biases, may distort children's symptom perceptions and reinforce illness beliefs (22). Parental cognitive factors including beliefs, coping strategies, and communication patterns, profoundly impact children's psychosomatic experiences.

5.7. Biological factors

In pediatric disorders, psychosomatic aspects often involve the interplay between biological factors and psychological stressors, leading to physical symptoms or exacerbation of underlying medical conditions.

5.7.1. Neuroendocrine System

Stress can trigger the release of hormones such as cortisol and adrenaline, which can affect various bodily functions including immune response, metabolism, and inflammation. Dysregulation of the neuroendocrine system due to chronic stress or trauma can contribute to the development or worsening of pediatric disorders (23).

5.7.2. Immune System

Psychological stress can modulate the immune system, leading to increased susceptibility to infections, autoimmune reactions, and inflammatory responses (23,24). In conditions like asthma and eczema, stress-induced immune dysregulation can worsen symptoms and trigger exacerbations (25–27).

5.7.3. Gastrointestinal System

The gut-brain axis plays a significant role in psychosomatic interactions. Stress can disrupt the balance of gut microbiota, leading to gastrointestinal symptoms such as abdominal pain, diarrhoea, and constipation (28). Disorders like irritable bowel syndrome (IBS) and other functional gastrointestinal disorders often have psychosomatic components (28,29).

5.7.4. Central Nervous System

Structural and functional changes in the brain due to stress can influence pain perception, mood regulation, and cognitive function. Pediatric disorders such as headaches, migraines, and functional neurological disorders (e.g., conversion disorder) often have psychosomatic components involving altered central nervous system processing (30,31).

5.7.5. Inflammatory Pathways

Chronic stress can trigger pro-inflammatory pathways within the body, leading to low-grade inflammation and oxidative stress (32).

These inflammatory processes are closely linked to numerous pediatric disorders, such as autoimmune conditions and inflammatory bowel disease, where psychosocial stressors can intensify symptoms (24).

6. Psychosomatic aspects in pediatric disorders

Psychosomatic aspects play a significant role in understanding and managing pediatric disorders, offering insights into the intricate interplay between biological, psychological, familial, and environmental factors. This section delineates various pediatric conditions where psychosomatic elements exert a notable influence, shaping disease outcomes and patient experiences. From asthma to functional neurological disorders, each condition presents unique challenges and complexities affected by stress, family dynamics, societal factors, and psychological well-being.

6.1. Asthma

Psychosocial stressors, such as poverty, exposure to violence, racism, and discrimination, have a profound impact on adolescents across individual, family, and community levels. In children, stress can notably influence asthma outcomes, especially among populations facing heightened psychosocial stress (33). Stressors can manifest as acute, short-term events or chronic, persistent challenges, both of which have been linked to increased asthma prevalence and worsened outcomes (25).

While the exact mechanisms linking stress and asthma remain unclear, it's believed that stress can directly affect gene expression, immune responses, and various physiological systems (25).

Family-level stressors, like caregiver depression, anxiety, and household chaos, significantly affect the health of a child, particularly for those with asthma (34). Strong family support and positive sibling relationships have been identified as protective factors against psychological distress in asthmatic children. Caregivers of children with asthma often experience elevated levels of depression and anxiety, impacting both their own and their child's health and socioeconomic status. Additionally, family chaos is associated with poorer asthma control and acts as a mediator between parental and child depressive symptoms and adverse asthma outcomes (25).

6.2. Atopic dermatitis

Atopic dermatitis (AD) is a chronic and recurrent condition characterised by skin barrier dysfunction, intense itching, and chronic inflammation. It has a complex aetiology involving genetic factors, impaired skin barrier, environmental triggers, and immune dysregulation. AD significantly impacts patients' quality of life, comparable to other chronic illnesses like epilepsy or diabetes. Psychological stress, a known trigger and exacerbator of AD, has been extensively studied (26). Epidemiological evidence suggests a relationship between AD and psychological stress, with higher stress levels reported in AD patients (26). Psychological stress can worsen AD symptoms through various neuroendocrine pathways, leading to neurogenic inflammation and disruption of the skin barrier function (26,27).

Episodes of symptom exacerbation are often triggered by environmental and microbiological factors, resulting in sleep disturbances and concentration issues. Managing the disease requires constant attention and treatment of flare-ups, leading to reduced quality of life and increased risk of psychosomatic illnesses such as ADHD and depression. In children, the impact extends to the entire family, causing disruptions in daily life (27).

6.3. Headaches and Migraine

The complex nature of headaches involves various factors such as genetics, biology, medical conditions, neuropsychology, and psychological traits. Pediatric migraine illustrates the close interaction between physical and psychological aspects, evidenced by the strong correlation between stress and migraine attacks and the high prevalence of psychiatric comorbidities. Emotional distress or psychological issues in younger children often manifest through physical symptoms (35).

Pediatric migraine often presents with various accompanying symptoms and comorbidities, including neurological signs, sleep disturbances, allergies, school-related issues, and psychiatric conditions like anxiety and depression (35).

Children with migraine often exhibit psychobehavioural characteristics, including hyperactivity, distractibility, and low adaptability, which may stem from abnormal frontal function. White matter lesions observed in migraine patients, along with cognitive deficits, suggest underlying structural and functional brain abnormalities (35). Increased sensitivity to stress and changes in pain processing mechanisms observed may reduce the threshold for migraine attacks, especially in those prone to susceptibility (35).

Migraine is viewed as a disorder of psychobiological adaptation, where genetic predisposition interacts with internal and external environmental factors (35). The susceptibility to migraine

may represent an evolved defence mechanism, with head pain serving as a response to strong sensory stimuli or stressors (35).

6.4. Functional gastrointestinal disorders

Functional gastrointestinal disorders (FGIDs) are characterised by symptoms such as stomach pain, GI cramps, nausea, and heartburn. While the precise causes are not fully understood, dysregulation of the brain-gut communication axis is the leading theory (36).

FGIDs are believed to result from a complex interplay of genetic, physiological, psychological, and environmental factors affecting both the central nervous system and gastrointestinal motility. Managing FGIDs can be challenging, time-consuming, and financially costly for families and healthcare providers, with many children continuing to experience symptoms into adulthood (36).

Childhood environmental factors play a significant role in the development and exacerbation of functional gastrointestinal disorders. Parental beliefs, behaviours, and psychological status influence children's abdominal symptoms, with a strong association noted between parental anxiety, depression, and somatisation and children's symptoms (37).

Adverse life events such as abuse (physical, emotional, sexual) in childhood are linked to FGID severity and clinical outcomes (37), contributing to increased healthcare-seeking behaviour. Stressful life events, both in childhood and adulthood, exacerbate symptoms and predict poor treatment outcomes for FGIDs. Social support, though beneficial in reducing stress and symptom severity, can be outweighed by negative social relationships marked by conflict and adverse interactions (37).

Cultural beliefs, norms, and behaviours also influence the experience and management of FGIDs within families and communities (37).

6.5. Chronic pain

Chronic pain in children is a complex interplay of biological, psychological, and sociocultural factors, often considered within a developmental context. Central sensitisation, involving increased neural responsiveness in the central nervous system, is a key feature of many chronic pain conditions (38).

Children with persistent abdominal pain and headaches are more likely to experience physical symptoms, anxiety, and depression later in life. Factors such as pain catastrophising, fear of pain, and somatic symptoms contribute to the development and persistence of chronic pain (38,39).

Children's catastrophising is linked to poorer functioning and higher pain levels, predicting persistent pain into adulthood. Parents' catastrophic thinking about their child's pain correlates with restricting activities and prioritising pain control efforts. Parental catastrophising mediates the relationship between protective responses and disability levels. High levels of catastrophising in both parents and children are strongly associated with worse outcomes (40).

Pain-related fear plays a crucial role in the severity of pain and disability, leading to anticipatory fear responses and avoidant behaviours (41).

Addressing chronic pain in children is crucial not only for clinical care but also for its broader impact on medical, social, and economic sectors.

6.6. Functional neurological disorder

Functional Neurological Disorder (FND), also known as conversion disorder, is a somatoform disorder which presents with motor and sensory symptoms that defy conventional neurological diagnoses, causing significant distress and functional impairment (42). In children and adolescents, it involves the integration of lived experiences into the body and brain, resulting in stress system activation and changes in neural function (43).

FND poses challenges for outcome measurement due to symptom heterogeneity, variability, and the influence of attention, beliefs, and expectations. Subjective patient-reported outcomes gain importance in light of these complexities, as objective measures may not fully capture patients' experiences (42)

In children and adolescents, FND is a multifaceted condition involving intricate interactions between biological, psychological, familial, social, and ecological factors. The disorder manifests as a disruption in neurological functioning without an underlying organic cause, presenting with a diverse array of symptoms ranging from motor dysfunction to sensory disturbances. FND is characterised by maladaptive thought patterns and emotional responses that can exacerbate symptomatology. Negative thoughts and emotions, coupled with a heightened focus on symptoms, can perpetuate stress-system activation, thereby sustaining the illness process (44).

Beyond motor and sensory symptoms, FND patients often experience additional physical symptoms like fatigue and pain, as well as psychological symptoms like anxiety and depression, which impact quality of life and functioning (42). Children with FND often present with symptoms resembling neurological diseases, particularly seizures and motor-type symptoms (45).

7. Treatment methods

Today, there are multiple therapeutic approaches for addressing psychosomatic aspects in pediatric disorders. Each technique offers unique benefits, from enhancing emotional regulation to fostering social support and improving cognitive skills.

7.1. Meditation

Meditation techniques encompass a range of practices aimed at focusing attention without analytical thinking, promoting a quiet environment, utilising auditory or visual stimuli like mantras, and requiring a passive attitude in a comfortable position (46). Mind-body interventions, including meditation, can prevent stress-related issues and enhance emotional regulation (46). Studies show increased brain activation in the medial prefrontal cortex during meditation, indicating improved emotional processing (46).

7.2. Guided Imagery

Guided imagery, a technique suitable for children and adolescents, utilises mental visualisation to enhance mood and physical well-being. It is a stress and anxiety treatment method that replaces negative memories with positive mental imagery (47).

It offers a noninvasive approach to self-regulation by combining behavioural interventions like body relaxation with cognitive interventions such as guided imagery (46). The process involves three phases: body relaxation, where tension is gradually released while deep breathing; imagery, where the child visualises a favourite place or experience; and return to reality, where the child remains in the positive mental space before gradually returning to the surrounding environment (46).

7.3. Deep Breathing

Breathing practices involve voluntary adjustments to respiration, which is fundamental for physical, emotional, and spiritual development, aiding in tension release and stress reduction (46). Diaphragmatic breathing, characterised by abdominal expansion during inhalation, reduces oxygen consumption, heart rate, and blood pressure while increasing parasympathetic activity and reducing sympathetic activity (46,47). This technique, also known as deep breathing, promotes relaxation through mind-body integration, stimulating the vagus nerve and improving various factors like stress, anxiety, and negative affect (47).

7.4. Clinical Hypnosis

Clinical hypnosis utilises relaxation and mental imagery to help individuals break away from stressful environments (46). It involves interactions where the hypnotist provides suggestions to focus on inner experiences, influencing perceptions, emotions, thoughts, and behaviour to

replace dysfunctional patterns (46). Hypnosis aids in reducing stress levels in children, enabling better coping with challenging situations, which can result in improved mental health and overall well-being.

7.5. Progressive Muscle Relaxation

Progressive Muscle Relaxation (PMR) is an active relaxation technique involving the gradual tensing and releasing of muscles to induce relaxation (46). PMR utilises both "top-down" processing, where higher brain areas initiate muscle contraction, and "bottom-up" processing, where bodily tension stimulates proprioceptive pathways to the brain (47). Numerous studies demonstrate PMR's efficacy in reducing stress and improving symptoms of depression and anxiety (47).

7.6. Cognitive Behavioural Therapy

Cognitive Behavioural Therapy (CBT) is a structured psychological treatment incorporating various techniques to alter internal processes like thoughts, beliefs, emotions, and behaviours (46). It aims to replace dysfunctional patterns with more adaptive ones through collaboration and guidance (46). Grounded in behavioural analysis, cognitive theory, and social learning theory, CBT highlights the interplay between cognitions, emotions, and behaviours to achieve desired outcomes (48).

7.7. Interpersonal Therapy

Interpersonal Therapy (IPT) employs diverse strategies to tackle interpersonal issues, fostering social support, alleviating stress, and enhancing emotional processing and communication skills between young individuals and significant adults like parents or teachers, thereby ameliorating symptoms (46,48). Techniques include exploring emotions in social settings, nurturing supportive relationships, and refining communication skills through role-playing exercises (48).

7.8. Third Wave Therapies

Third-wave therapies prioritise overall well-being over simply treating symptoms. They integrate psychological, cognitive, and behavioural principles from various approaches like CBT, mindfulness, and acceptance (48). These therapies aim to alter how individuals relate to their thoughts and emotions rather than changing the content (48,49). Examples include acceptance and commitment therapy (ACT), mindfulness-based cognitive therapy (MBCT), dialectical behaviour therapy (DBT), and the expanded model of behavioural activation (BA) (49). Providing a transdiagnostic approach, these interventions address shared psychological

processes relevant across various mental health conditions, a critical consideration amid the growing mental health complexities encountered by children and adolescents (49).

7.9. Mindfulness

Mindfulness, characterised by present moment awareness without judgment, has gained attention for its stress reduction benefits, particularly in mindfulness-based interventions (MBIs) (46). Mindfulness training enhances skills like nonjudgmental attention control, which can lead to improved behaviour and reduced psychopathology symptoms (50). While initially developed for adults to cope with illness and stress, MBIs have expanded to include children and adolescents. This expansion is driven by the potential benefits of mindfulness in enhancing cognitive skills, supporting academic and social functioning, and preventing the onset of mental health issues (50).

7.10. Attachment-based Family Therapy

Attachment-based Family Therapy (ABFT) is a therapeutic approach centred on processes and emotions, with the goal of addressing key family conflicts and attachment ruptures that inhibit adolescents' trust in their parents (51). ABFT aims to enhance the functioning and interactional dynamics between adolescents and parents, fostering a nurturing environment conducive to individual development (51). Grounded in attachment theory, ABFT addresses adolescent depression, suicidality, and trauma by capitalising on the innate desire for secure relationships (13). Therapy emphasises identifying and addressing attachment ruptures, using family conversations as experiential learning opportunities to improve emotion regulation and conflict resolution skills (13). By providing corrective attachment experiences, ABFT aims to restore healthy caregiver-child relationships.

7.11. Parent-Child Interaction Therapy

Parent-Child Interaction Therapy (PCIT) is an evidence-based intervention for children which integrates play therapy components into behavioural parent training, targeting problematic behaviour by modifying parental behaviour and interactions (52). Using attachment theory and social learning theory, PCIT focuses on reshaping parent-child interactions rather than directly engaging children (52). Therapists provide personalised live coaching sessions for parents, assisting them in enhancing communication, offering positive attention, problem-solving, maintaining consistency, and following through with strategies (52). PCIT consists of two phases: Child-Directed Interaction (CDI) and Parent-Directed Interaction (PDI), each targeting specific parenting skills to increase positive interactions and reduce disruptive behaviours (53).

7.12. Trauma-focused Cognitive Behavioural Therapy

Trauma-Focused Cognitive Behavioural Therapy (TF-CBT) is a structured intervention aimed at reducing post-traumatic stress disorder (PTSD) symptoms in children and adolescents (53). TF-CBT addresses various traumas, including sexual abuse, physical abuse, neglect and domestic violence (53). The therapy focuses on psychoeducation, parenting skills, relaxation, affective expression and modulation, cognitive coping skills, trauma narration and processing, in vivo mastery of trauma reminders, conjoint child-parent sessions, and the enhancement of safety and future development (54). TF-CBT emphasises developmentally appropriate strategies for children and incorporates nonoffending caregivers into the recovery process (55).

7.13. Cognitive Bias Modification

Cognitive Bias Modification (CBM) interventions aim to address cognitive processes linked to various psychological disorders, prioritising underlying dysfunctions rather than observable symptoms (56). Advanced CBM techniques like Attention Bias Modification (ABM) employ spatial cues or gaze-contingent reinforcement to train individuals to shift their attention away from negative stimuli (56). Meanwhile, Cognitive Bias Modification of Interpretation (CBM-I) focuses on training individuals to interpret ambiguous information in a neutral or positive manner rather than a negative one (56). By shifting attentional biases and modifying cognitive processing patterns, CBM can help reduce symptom severity and improve psychological well-being in children with psychosomatic disorders.

8. Discussion

The synthesis of the literature on psychosomatic aspects in pediatric disorders reveals intricate connections among psychological, social, and biological factors across various conditions. Exploring specific disorders like asthma, atopic dermatitis, headaches and migraines, functional gastrointestinal disorders, chronic pain, and functional neurological disorders uncovers a complex interplay between psychosomatic influences and disease outcomes.

In asthma, family dynamics and coping mechanisms significantly influence symptom severity (57,58), with stressors exacerbating symptoms (33) and maladaptive coping strategies worsening them. Similarly, in atopic dermatitis, psychological stress plays a pivotal role in disease severity (59), while family dynamics and social support critically impact treatment adherence and disease management (60).

Headaches and migraines are intricately linked to stress and cognitive factors, with family dynamics and social support networks moulding coping strategies and treatment outcomes. Functional gastrointestinal disorders also bear the weight of family dynamics and stress (37), with maladaptive coping mechanisms worsening symptoms and impairing quality of life.

Chronic pain in children is a product of stress, coping mechanisms, and family dynamics (39,61,62), with stress-induced alterations in neuroendocrine and immune function exacerbating pain. In functional neurological disorder, maladaptive thought patterns and emotional responses, combined with stressful life events and family dynamics, serve to trigger or exacerbate symptoms (44).

Stress emerges as a central psychosomatic aspect across these disorders, exerting a profound impact on children's physical health and symptom severity. Attachment theory underscores the importance of early caregiver-child relationships in buffering against stress-induced dysregulation. At the same time family dynamics significantly shape pediatric health outcomes by serving as both a source of support and a potential stressor for children facing medical conditions or psychosocial challenges (16).

Coping mechanisms, such as somatisation, avoidance, and maladaptive coping, illustrate the complex interaction of psychological and physiological elements, acting as adaptive strategies for handling emotional distress. Social support functions as a protective barrier against stressors, assisting children in maintaining emotional and physical resilience amidst illness, and plays a critical role in pediatric psychosomatic medicine by shaping coping mechanisms and adaptation to medical conditions (20).

Cognitive factors, including illness perceptions and beliefs, exert a significant influence on symptom experiences, highlighting the interconnectedness of psychological and physical domains in pediatric health.

Holistic approaches to pediatric healthcare are imperative, given the intricate interplay between psychological and physical factors (3). By addressing psychosocial aspects alongside biomedical interventions, healthcare providers can optimise outcomes and enhance the well-being of pediatric patients.

Treatment options including mind-body interventions such as meditation, guided imagery, deep breathing, and clinical hypnosis foster relaxation, emotional regulation, and stress reduction (46). Cognitive-behavioural therapies target maladaptive social, behavioural, and cognitive factors to alleviate symptoms and prevent recurrence (63). Third-wave therapies, such as acceptance and commitment therapy, provide a transdiagnostic perspective, focusing on common psychological processes that span from distress to well-being rather than

adhering to particular models of illness or disease (64). Attachment-based family therapy and parent-child interaction therapy concentrate on improving family relationships and communication patterns, providing a supportive environment for children's emotional and psychological development. Trauma-focused cognitive-behavioural therapy provides structured interventions for addressing post-traumatic stress disorder symptoms in pediatric populations, emphasising caregiver involvement and psychoeducation (55).

What ties these therapeutic approaches together is their collaborative nature, emphasising the interaction between patients, families, and healthcare providers.

The emphasis on collaboration between patients, families, and healthcare providers, as highlighted in the review, echoes the patient-centred approach advocated in pediatric care.

9. Conclusion

This literature review underscores the profound impact of psychosomatic aspects on pediatric disorders, highlighting the intricate interplay between biological, psychological, familial, and environmental factors. Through various lenses such as stress, attachment theory, family dynamics, coping mechanisms, social support, cognitive factors, and biological pathways, the review illuminates the multifaceted nature of pediatric disorders with psychosomatic components.

Understanding these psychosomatic aspects is crucial for providing comprehensive care to pediatric patients, as they significantly influence disease outcomes, treatment adherence, and overall well-being. By recognising the complex interplay between psychological factors and physical health outcomes, healthcare professionals can tailor interventions to address the unique needs of children facing these challenges.

Future research should focus on further elucidating the mechanisms underlying psychosomatic aspects in pediatric disorders and identifying effective interventions to mitigate their impact. Longitudinal studies examining the trajectory of psychosomatic symptoms over time and their association with disease progression would provide valuable insights into the course of pediatric disorders.

Interventions targeting psychosocial factors, such as stress management techniques, attachment-based interventions, and family therapy, warrant further investigation to optimize treatment outcomes for pediatric patients. Collaborative efforts among healthcare providers, psychologists, educators, and community organisations are essential for implementing

holistic approaches to pediatric care that address both the physical and psychological dimensions of illness.

Considering the vast array of treatment methods available today, it is crucial to continue exploring and refining these approaches. These treatments offer diverse benefits and emphasize collaboration between patients, families, and healthcare providers, promoting comprehensive care tailored to each child's needs.

Future research could focus on evaluating the comparative effectiveness of these treatment modalities, identifying optimal combinations for specific pediatric populations, and exploring innovative approaches that integrate emerging technologies or cultural adaptations. By advancing our understanding of psychosomatic aspects in pediatric disorders and optimizing treatment methods, we can enhance the well-being and quality of life of children facing these complex health challenges, ultimately leading to better outcomes in pediatric healthcare.

10. References

1. Andrea AC. Historical evolution of the concept of health in Western medicine. Acta Bio Medica Atenei Parm. 2018;89(3):352–4.

2. Deter HC, Orth-Gomér K, Wasilewski B, Verissimo R. The European Network on Psychosomatic Medicine (ENPM) – history and future directions. Biopsychosoc Med. 2017 Jan 26;11:3.

3. Fava GA, Guidi J, Sonino N. The Psychosomatic Practice. Acta Derm Venereol. 2016 Aug 23;96(217):9–13.

4. Papadimitriou G. The 'Biopsychosocial Model': 40 years of application in Psychiatry. Psychiatr Psychiatr. 2017;28(2):107–10.

5. Kusnanto H, Agustian D, Hilmanto D. Biopsychosocial model of illnesses in primary care: A hermeneutic literature review. J Fam Med Prim Care. 2018;7(3):497–500.

6. Torrubia-Pérez E, Reverté-Villarroya S, Fernández-Sáez J, Martorell-Poveda MA. Analysis of Psychosomatic Disorders According to Age and Sex in a Rural Area: A Population-Based Study. J Pers Med. 2022 Oct 18;12(10):1730.

7. Compas BE, Jaser SS, Bettis AH, Watson KH, Gruhn M, Dunbar JP, et al. Coping, Emotion Regulation and Psychopathology in Childhood and Adolescence: A Meta-Analysis and Narrative Review. Psychol Bull. 2017 Sep;143(9):939–91.

8. Daniels T, Olsen E, Tyrka AR. Stress and Psychiatric Disorders: The Role of Mitochondria. Annu Rev Clin Psychol. 2020 May 7;16:165–86.

9. Healthy Lifestyle in Adolescence: Associations with Stress, Self-Esteem and the Roles of School Violence - PMC [Internet]. [cited 2024 May 9]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10778914/

10. Papapetrou C, Panoulis K, Mourouzis I, Kouzoupis A. Pregnancy and the perinatal period: The impact of attachment theory. Psychiatr Psychiatr. 2020;31(3):257–70.

11. Bosmans G, Van Vlierberghe L, Bakermans-Kranenburg MJ, Kobak R, Hermans D, van IJzendoorn MH. A Learning Theory Approach to Attachment Theory: Exploring Clinical Applications. Clin Child Fam Psychol Rev. 2022;25(3):591–612.

12. Bosmans G, Bakermans-Kranenburg MJ, Vervliet B, Verhees MWFT, van IJzendoorn MH. A learning theory of attachment: Unraveling the black box of attachment development. Neurosci Biobehav Rev. 2020 Jun;113:287–98.

13. Diamond G, Diamond GM, Levy S. Attachment-based family therapy: Theory, clinical model, outcomes, and process research. J Affect Disord. 2021 Nov 1;294:286–95.

14. Härkönen J, Bernardi F, Boertien D. Family Dynamics and Child Outcomes: An Overview of Research and Open Questions. Eur J Popul Rev Eur Démographie. 2017 Mar 22;33(2):163–84.

15. Obimakinde AM, Shabir M. The family dynamics of children on the streets of Ibadan, Southwest Nigeria. South Afr Fam Pract. 2023 Dec 14;66(1):5774.

16. Jabbari B, Schoo C, Rouster AS. Family Dynamics. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 May 9]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK560487/

17. Karhina K, Bøe T, Hysing M, Nilsen SA. Parental separation, negative life events and mental health problems in adolescence. BMC Public Health. 2023 Nov 29;23:2364.

18. Jones AC, Kassam-Adams N, Ciesla JA, Barakat LP, Marsac ML. A Prospective Examination of Child Avoidance Coping and Parental Coping Assistance After Pediatric Injury: A Mixed-Methods Approach. J Pediatr Psychol. 2019 Sep;44(8):914–23.

19. Fairfax A, Brehaut J, Colman I, Sikora L, Kazakova A, Chakraborty P, et al. A systematic review of the association between coping strategies and quality of life among caregivers of children with chronic illness and/or disability. BMC Pediatr. 2019 Jul 1;19:215.

20. Bauer A, Stevens M, Purtscheller D, Knapp M, Fonagy P, Evans-Lacko S, et al. Mobilising social support to improve mental health for children and adolescents: A systematic review using principles of realist synthesis. PLoS ONE. 2021 May 20;16(5):e0251750.

21. Sawyer AT, Harris SL, Koenig HG. Illness perception and high readmission health outcomes. Health Psychol Open. 2019 Apr 23;6(1):2055102919844504.

22. Lau JYF, Heathcote LC, Beale S, Gray S, Jacobs K, Wilkinson N, et al. Cognitive Biases in Children and Adolescents With Chronic Pain: A Review of Findings and a Call for Developmental Research. J Pain. 2018 Jun 1;19(6):589–98.

23. Zefferino R, Di Gioia S, Conese M. Molecular links between endocrine, nervous and immune system during chronic stress. Brain Behav. 2020 Dec 8;11(2):e01960.

24. Ge L, Liu S, Li S, Yang J, Hu G, Xu C, et al. Psychological stress in inflammatory bowel disease: Psychoneuroimmunological insights into bidirectional gut–brain communications. Front Immunol. 2022 Oct 6;13:1016578.

25. Landeo-Gutierrez J, Celedón JC. Chronic stress and asthma in adolescents. Ann Allergy Asthma Immunol Off Publ Am Coll Allergy Asthma Immunol. 2020 Oct;125(4):393–8.

26. Lönndahl L, Abdelhadi S, Holst M, Lonne-Rahm SB, Nordlind K, Johansson B. Psychological Stress and Atopic Dermatitis: A Focus Group Study. Ann Dermatol. 2023 Oct;35(5):342–7.

27. Klasa B, Cichocka-Jarosz E. Atopic Dermatitis – Current State of Research on Biological Treatment. J Mother Child. 2020 Jul 29;24(1):53–66.

28. Zia JK, Lenhart A, Yang PL, Heitkemper MM, Baker J, Keefer L, et al. Risk Factors for Abdominal Pain–Related Disorders of Gut–Brain Interaction in Adults and Children: A Systematic Review. Gastroenterology. 2022 Oct;163(4):995-1023.e3.

29. Cryan JF, O'Riordan KJ, Cowan CSM, Sandhu KV, Bastiaanssen TFS, Boehme M, et al. The Microbiota-Gut-Brain Axis. Physiol Rev. 2019 Oct;99(4):1877–2013.

30. Puledda F, Silva EM, Suwanlaong K, Goadsby PJ. Migraine: from pathophysiology to treatment. J Neurol. 2023;270(7):3654–66.

31. Hallett M, Aybek S, Dworetzky BA, McWhirter L, Staab J, Stone J. Functional Neurological Disorder: New Phenotypes, Common Mechanisms. Lancet Neurol. 2022 Jun;21(6):537–50.

32. Slavich GM, Irwin MR. From Stress to Inflammation and Major Depressive Disorder: A Social Signal Transduction Theory of Depression. Psychol Bull. 2014 May;140(3):774–815.

33. de Benedictis FM, Attanasi M. Asthma in childhood. Eur Respir Rev. 2016 Mar;25(139):41–7.

34. Plaza-González S, Zabala-Baños M del C, Astasio-Picado Á, Jurado-Palomo J. Psychological and Sociocultural Determinants in Childhood Asthma Disease: Impact on Quality of Life. Int J Environ Res Public Health. 2022 Feb 24;19(5):2652.

35. Guidetti V, Faedda N, Siniatchkin M. Migraine in childhood: biobehavioural or psychosomatic disorder? J Headache Pain. 2016 Sep 8;17(1):82.

36. Selimović A, Mekić N, Terzić S, Ćosićkić A, Zulić E, Mehmedović M. Functional gastrointestinal disorders in children: a single centre experience. Med Glas Off Publ Med Assoc Zenica-Doboj Cant Bosnia Herzeg. 2024 Feb 1;21(1):112–7.

37. Oudenhove LV, Levy RL, Crowell MD, Drossman DA, Halpert AD, Keefer L, et al. Biopsychosocial Aspects of Functional Gastrointestinal Disorders: How Central and

Environmental Processes Contribute to the Development and Expression of Functional Gastrointestinal Disorders. Gastroenterology. 2016 Feb 18;S0016-5085(16)00218-3.

38. Friedrichsdorf SJ, Giordano J, Desai Dakoji K, Warmuth A, Daughtry C, Schulz CA. Chronic Pain in Children and Adolescents: Diagnosis and Treatment of Primary Pain Disorders in Head, Abdomen, Muscles and Joints. Children. 2016 Dec 10;3(4):42.

39. Locher C, Wörner A, Carlander M, Kossowsky J, Dratva J, Koechlin H. Chronic pain concepts of pediatricians: a qualitative survey. Pain Rep. 2023 Jan 16;8(1):e1060.

40. Pielech M, Ryan M, Logan D, Kaczynski K, White MT, Simons LE. Pain catastrophizing in children with chronic pain and their parents: Proposed clinical reference points and re-examination of the PCS measure. Pain. 2014 Nov;155(11):2360–7.

41. Dekker C, van Haastregt JCM, Verbunt JAMCF, de Jong JR, van Meulenbroek T, Pernot HFM, et al. Pain-related fear in adolescents with chronic musculoskeletal pain: process evaluation of an interdisciplinary graded exposure program. BMC Health Serv Res. 2020 Mar 14;20:213.

42. Pick S, Anderson DG, Asadi-Pooya AA, Aybek S, Baslet G, Bloem BR, et al. Outcome measurement in functional neurological disorder: a systematic review and recommendations. J Neurol Neurosurg Psychiatry. 2020 Jun;91(6):638–49.

43. Kozlowska K, Chudleigh C, Savage B, Hawkes C, Scher S, Nunn KP. Evidence-Based Mind-Body Interventions for Children and Adolescents with Functional Neurological Disorder. Harv Rev Psychiatry. 2023;31(2):60–82.

44. Kozlowska K, Schollar-Root O, Savage B, Hawkes C, Chudleigh C, Raghunandan J, et al. Illness-Promoting Psychological Processes in Children and Adolescents with Functional Neurological Disorder. Children. 2023 Oct 24;10(11):1724.

45. Perjoc RS, Roza E, Vladacenco OA, Teleanu DM, Neacsu R, Teleanu RI. Functional Neurological Disorder–Old Problem New Perspective. Int J Environ Res Public Health. 2023 Jan 8;20(2):1099.

46. Zisopoulou T, Varvogli L. Stress Management Methods in Children and Adolescents: Past, Present, and Future. Horm Res Paediatr. 2023;96(1):97–107.

47. Effectiveness of Progressive Muscle Relaxation, Deep Breathing, and Guided Imagery in Promoting Psychological and Physiological States of Relaxation - PMC [Internet]. [cited 2024 May 9]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8272667/

48. Hetrick SE, Cox GR, Witt KG, Bir JJ, Merry SN. Cognitive behavioural therapy (CBT), third-wave CBT and interpersonal therapy (IPT) based interventions for preventing depression in children and adolescents. Cochrane Database Syst Rev. 2016 Aug 9;2016(8):CD003380.

49. Perkins AM, Meiser-Stedman R, Spaul SW, Bowers G, Perkins AG, Pass L. The effectiveness of third wave cognitive behavioural therapies for children and adolescents: A systematic review and meta-analysis. Br J Clin Psychol. 2023 Mar;62(1):209–27.

50. Dunning DL, Griffiths K, Kuyken W, Crane C, Foulkes L, Parker J, et al. Research Review: The effects of mindfulness-based interventions on cognition and mental health in children and adolescents – a meta-analysis of randomized controlled trials. J Child Psychol Psychiatry. 2019 Mar;60(3):244–58.

51. Effectiveness of attachment-based family therapy compared to treatment as usual for depressed adolescents in community mental health clinics - PMC [Internet]. [cited 2024 May 9]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7881666/

52. Carpenter AL, Puliafico AC, Kurtz SMS, Pincus DB, Comer JS. Extending Parent–Child Interaction Therapy for Early Childhood Internalizing Problems: New Advances for an Overlooked Population. Clin Child Fam Psychol Rev. 2014 Dec;17(4):340–56.

53. Shenk CE, Keeshin B, Bensman HE, Olson AE, Allen B. Behavioral and pharmacological interventions for the prevention and treatment of psychiatric disorders with children exposed to maltreatment. Pharmacol Biochem Behav. 2021 Dec;211:173298.

54. Kameoka S, Tanaka E, Yamamoto S, Saito A, Narisawa T, Arai Y, et al. Effectiveness of trauma-focused cognitive behavioral therapy for Japanese children and adolescents in community settings: a multisite randomized controlled trial. Eur J Psychotraumatology. 11(1):1767987.

55. Cohen JA, Mannarino AP. Trauma-Focused Cognitive Behavioral Therapy for Traumatized Children and Families. Child Adolesc Psychiatr Clin N Am. 2015 Jul;24(3):557–70.

56. Gober CD, Lazarov A, Bar-Haim Y. From cognitive targets to symptom reduction: overview of attention and interpretation bias modification research. Evid Based Ment Health. 2021 Feb;24(1):42–6.

57. Al Ghriwati N, Winter MA, Everhart RS, Fiese BH. Family Functioning and Child Asthma Severity: A Bio-Behavioral Approach. Fam Syst Health J Collab Fam Healthc. 2017 Dec;35(4):439–49.

58. Rodríguez EM, Kumar H, Bearman SK, Buttlar AM von, Sánchez-Johnsen L. Physician Perceptions of Children's Coping with Asthma are Associated with Children's Psychosocial and Disease Functioning. Fam Syst Health J Collab Fam Healthc. 2018 Sep;36(3):327.

59. Wollenberg A, Werfel T, Ring J, Ott H, Gieler U, Weidinger S. Atopic Dermatitis in Children and Adults. Dtsch Ärztebl Int. 2023 Mar;120(13):224–34.

60. ALI F, VYAS J, FINLAY AY. Counting the Burden: Atopic Dermatitis and Health-related Quality of Life. Acta Derm Venereol. 2020 Jun 9;100(12):5766.

61. Post-traumatic stress symptoms in children and adolescents with chronic pain: A topical review of the literature and a proposed framework for future research - PMC [Internet]. [cited 2024 May 9]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5912261/

62. Palermo TM, Valrie CR, Karlson CW. Family and Parent Influences on Pediatric Chronic Pain: A Developmental Perspective. Am Psychol. 2014;69(2):142–52.

63. Psychological interventions for parents of children and adolescents with chronic illness - PMC [Internet]. [cited 2024 May 9]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6450193/

64. Hayes SC, Hofmann SG. The third wave of cognitive behavioral therapy and the rise of process-based care. World Psychiatry. 2017 Oct;16(3):245–6.

Vilniaus universiteto studento, teikiančio baigiamąjį darbą, GARANTIJA

PLEDGE of Vilnius University student submitting a thesis

Vardas ir pavardė: / Given name and surname:	Carl Frieder von Eisenhart-Rothe
Padalinys: / Faculty:	Faculty of medicine
Studijų programa: / Study programme:	Integrated studies
Darbo pavadinimas: / Thesis topic:	Psychosomatic Aspects in Pediatric Disorders
Darbo tipas: / Thesis type:	Narrative review

Garantuoju, kad mano baigiamasis darbas yra parengtas sąžiningai ir savarankiškai, kitų asmenų indėlio į parengtą darbą nėra. Jokio neteisėto atlygio už šį darbą niekam nesu mokėjęs. Šiame darbe tiesiogiai ar netiesiogiai panaudotos kitų šaltinių citatos pažymėtos literatūros nuorodose.

I pledge that my thesis has been prepared in good faith and independently and that there has been no contribution by other individuals to this thesis. I have not made any illegal payments related to this thesis. Quotes from other sources used in this thesis, directly or indirectly, are indicated in the list of references.

Aš, [Vardas Pavardė], patvirtinu (pažymėti)

I, Carl Frieder von Eisenhart-Rothe, *confirm (check)* ✓

Patvirtinu, kad baigiamasis darbas yra įkeltas į Vilniaus universiteto studijų informacinę sistemą.

I declare that this thesis has been uploaded to the Vilnius University Study Information System.

Carl von Eisenhart-Rothe (vardas ir pavardė / *name, surname*) | (parašas / *signature*) | 10.05.2024 (data / *date*)

Embargo laikotarpis / *Embargo period*

Prašau nustatyti šiam baigiamajam darbui toliau nurodytos trukmės embargo laikotarpį:

I am requesting an embargo on this thesis for the period indicated below:

☐ _____ mėnesių / months [embargo laikotarpis negali viršyti 60 mėn. / *an embargo period cannot not exceed 60 months*];

☑ embargo laikotarpis nereikalingas / *no embargo period is requested.*

Embargo laikotarpio nustatymo priežastis / *reason for the embargo period*:

_____

Carl von Eisenhart-Rothe		10.05.2024
(vardas ir pavardė / *name, surname*)	(parašas / *signature*)	(data / *date*)

Padalinio administratoriaus patvirtinimas, kad baigiamasis darbas buvo pateiktas ir užregistruotas / *Confirmation from the unit administrator that the thesis has been submitted and registered*:

(vardas ir pavardė / *name, surname*)	(parašas / *signature*)	(data / *date*)